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NOTES ON GEOGRAPHIC DISTRIBUTION

New records of Gerromorpha (Insecta: Hemiptera: Heteroptera) from Costa Rica

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ABSTRACT: The Gerromorpha from Costa Rica are poorly studied, except the Gerridae. Aiming to fill this gap, specimens collected across the country were examined. *Lipogomphus leucostictus*, *Hydrometra alloiona*, *H. australis*, *H. huallagana*, *Microvelia albonotata*, *M. argentata*, *M. laesslei*, *M. mimula*, *M. panamensis*, *M. psilonota*, *M. pulchella*, *M. signata*, and *M. torquata* are newly recorded from Costa Rica. Presences of *Hebrus concinnus*, *Mesovelia amoena*, and *Platyvelia brachialis* are confirmed. New provincial records are provided for *Hebrus consolidus*, *H. spiculus*, *Hydrometra caraiba*, *Mesovelia mulsanti*, *Mesoveloidea williamsi*, *Microvelia reflexa*, *M. schmidti*, and *Stridulivelia cinctipes*.

Costa Rica (Figure 1) is a Central American country with a terrestrial territory of about 52000 km^2. It has a central mountain range that divides the country in two slopes, the Caribbean and the Pacific, with many different habitats that shelter species from North American and South American origin. The country is well known for its high biodiversity in terms of species richness and endemicity (Springer 2008).

Gerromorpha is a group of true bugs in which representatives of most species have the ability to move about on the water surface, being semiaquatic or occasionally riparian (Hilsenhoff 2001). Their habitats range from a few square centimeters of surface area in the water accumulated in tree holes to the millions of square kilometers of the world's great oceans (Andersen 1982). This group of insects has barely been studied thus far in Costa Rica and, with exception of the family Gerridae (Pacheco Chaves 2010), the fauna of semiaquatic bugs from the country is known from only a few isolated descriptions and records.

This paper represents the first attempt to improve our knowledge of the Costa Rican representatives of the families Hebridae, Hydrometridae, Mesoveliidae and Veliidae, providing several new distributional records for most of the species mentioned, and confirming the presence of others in the country. This was done by examining specimens previously deposited in the Aquatic Entomology Collection of the Museo de Zoología, Universidad de Costa Rica (MZUCR), and additional material collected in the field, including nearly all regions in Costa Rica, and newly deposited on the same museum.

Family Hebridae (Figure 2)
Hebrus concinnus Uhler, 1894

Recorded from Costa Rica without details by Drake and Harris (1943).

Material examined. Alajuela – San Carlos, Balsa River, P. H. Balsa before Tapesco, 04.VIII.2011, (R. Lara): 1 apterous male. San Carlos, La Vieja River, P. H. Chocosuela I, dam station, 730 m a.s.l., 04.XII.2001, (M. Springer): 5 macropterous males, 5 macropterous females. San Ramón, San Lorenzo River, above dam, 03.VI.2013, (B. Pacheco & F. Reyes): 3 macropterous males, 1 macropterous female. Guanacaste – Hojancha, Nosara River, 850 m a.s.l., 14.IX.2003, (A. Y. Jiménez): 1 macropterous male. Heredia – Sarapiquí, Est. Tirimbina, Sarapiquí River, 03.X.2005, (M. Werner): 3 macropterous males, 1 macropterous female. Sarapiquí, InBio Station, Costa Rica River, 05.XI.2002, (A. Y. Jiménez): 1 macropterous male. Limón – Braulio Carrillo National Park, Botarrama Stream, González Stream Sector, 29.I.2006: 10 macropterous males, 3 macropterous females. Puntarenas – Golfito, Purruja River, before tannery, 10 m a.s.l., IV-V.1999, (T. Hermanson & J. Steffen): 1 macropterous male. San José – Coronado, Las Nubes, Cascajal, Potrera Stream, 1100 m a.s.l., 10.XI.2005, (C. Boza): 1 macropterous male [**Presence in Costa Rica confirmed**].

Hebrus consolidus Uhler, 1894

Known distribution in Costa Rica: San José (Drake and Harris 1943).

Material examined. Guanacaste – Cañas, site 10, South Channel, VII.2010, (B. Pacheco & D. Vásquez): 1 macropterous female. Heredia – Sarapiquí, Organization for Tropical Studies, La Selva Biological Station, La Flaminea marsh, VII.1992, (A. Schlagbauer): 3 macropterous males, 4 macropterous females. Limón – Limón, Chocolate Stream, 24 m a.s.l., 03.V.2013, (B. Pacheco & F. Reyes): 3 macropterous males, 1 macropterous female

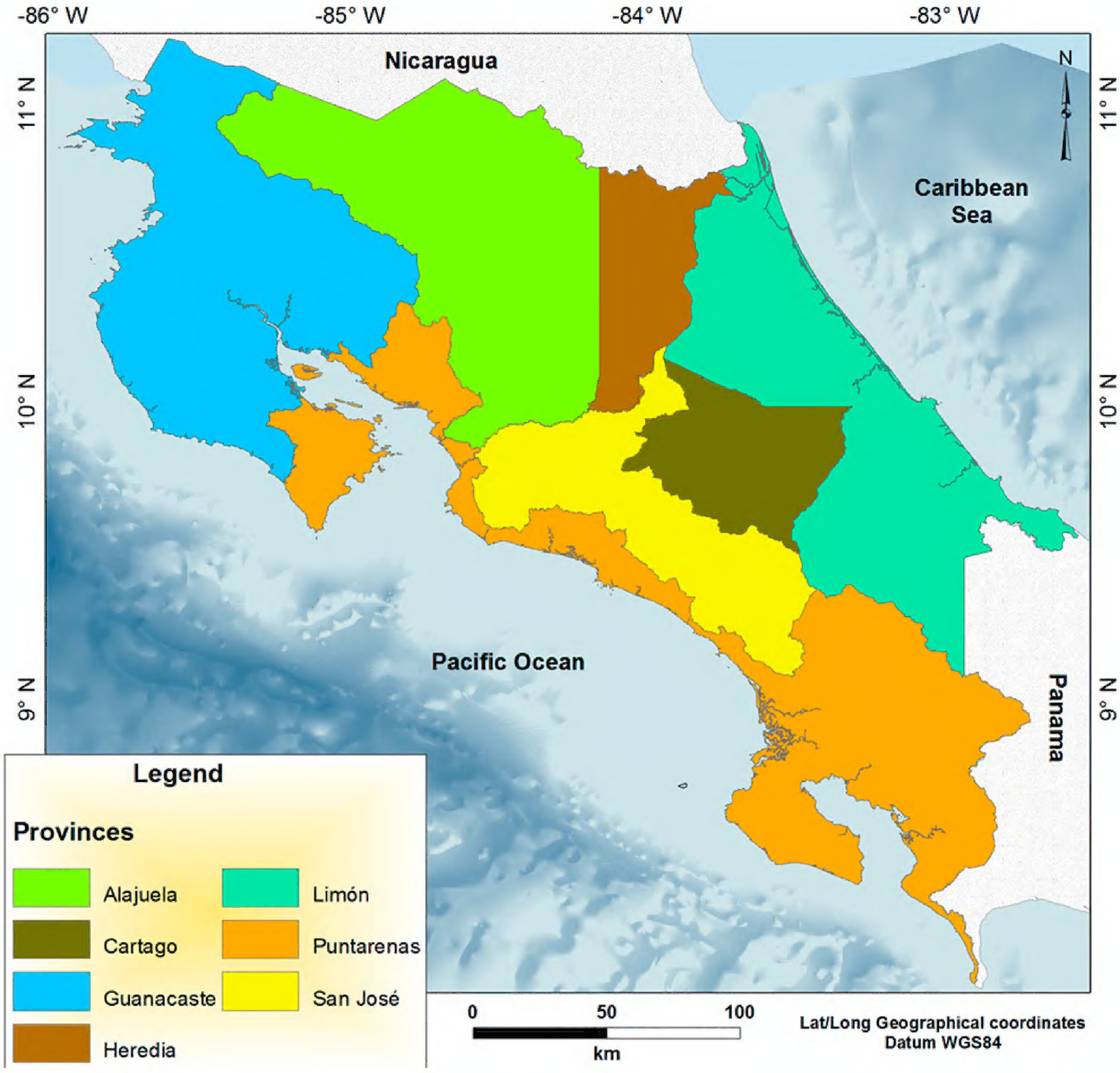

FIGURE 1. Map of Costa Rica showing its provinces.

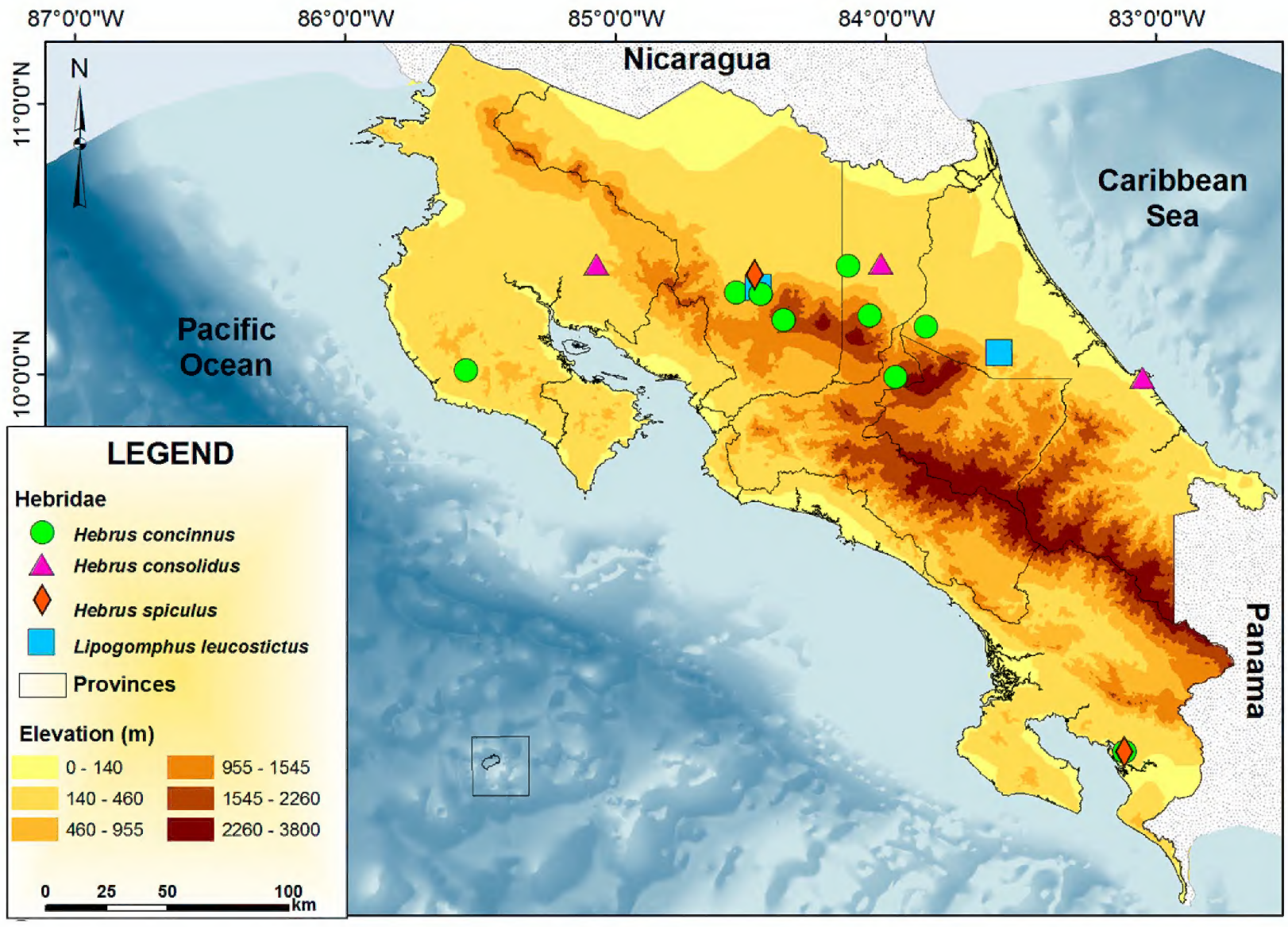

FIGURE 2. Map of Costa Rica showing the collecting localities of the family Hebridae.

[**First record from Guanacaste, Heredia, and Limón provinces**].

Hebrus spiculus Polhemus & McKinnon, 1983

Known distribution in Costa Rica: Puntarenas, San José (Polhemus and McKinnon 1983).

Material examined. Alajuela – San Carlos, Peñas Blancas River, bridge on road to La Fortuna, 260 m a.s.l., 08.XII.1998, (M. Springer & P. Paaby): 1 macropterous male [**First record from Alajuela province**]. Puntarenas – Golfito, Purruja River, before tannery, 10 m a.s.l., IV-V.1999, (T. Hermanson & J. Steffen): 1 macropterous male.

Lipogomphus leucostictus (Champion, 1898)

Previously recorded only from Guatemala, Nicaragua and Panama (Drake and Chapman 1958).

Material examined. Alajuela – San Carlos, Florencia, La Vieja River, powerhouse of P. H. Chocosuela II, 325 m a.s.l. Limón – Peje Lake, Reventazón Project, 30 m a.s.l., I.2012, (B. Pacheco & F. Reyes): 1 macropterous male [**First record from Costa Rica**].

Family Hydrometridae (Figure 3)

Hydrometra alloiona Drake & Lauck, 1959

Previously known only from the type collected in Nicaragua (Drake and Lauck 1959).

Material examined. Heredia – Sarapiquí, Guayacán, 600 m a.s.l., 17.IV.2009, (B. Pacheco): 1 macropterous male, 1 brachypterous female [**First record from Costa Rica**].

Hydrometra australis Say, 1832

Previously known from southern United States to Antigua (Muñoz *et al.* 2010).

Material examined. Limón – Peje Lake, Reventazón Project, 30 m a.s.l., XI.2011, (B. Pacheco & F. Reyes): 1 apterous male, 5 apterous females, 1 nymph; I.2012: 2 apterous males; Peje Lake 2, Reventazón Project, VIII.2010, (B. Pacheco & D. Vásquez): 1 apterous male; Los Chorros, Reventazón Project, 12.I.2011, (B. Pacheco, F. Villalobos & J. Bermúdez): 1 apterous female [**First record from Costa Rica**].

Hydrometra caraiba Guérin-Méneville, 1856

Known distribution in Costa Rica: Alajuela, Guanacaste (Moreira 2013).

Material examined. Guanacaste – Palo Verde, Lomas Barbudal Corridor, Barbudal Stream, 15.I.2007, (B. Pacheco): 14 macropterous males, 19 macropterous females. Bagaces, Palo Verde National Park, wetland, dense aquatic vegetation, 10 m a.s.l., 28-29.X.2005, (C. Lizana): 1 macropterous male. Bagaces, Palo Verde National Park, pond, less than 100 m a.s.l., 29.X.2005, (M. Losilla): 1 macropterous male. Puntarenas – Puntarenas, Barranca, ponds on road parallel to Barranca River, 45 m a.s.l., 13-16.IX.1998, (F. Mejía): 1 macropterous female. Puntarenas, Monteverde, lake in front of "La Cascada", 1400 m a.s.l, 01.III.1998, (M. Springer): 2 macropterous males, 1 macropterous female [**First record from Puntarenas province**].

Hydrometra huallagana Drake, 1954

Previously known only from the types collected in Peru (Drake 1954).

Material examined. Alajuela – San Ramón, small lake at Universidad de Costa Rica, (A. Loria): 1 brachypterous male; 10.XII.2000 (A. Rd2): 1 brachypterous male, 1 macropterous female [**First record from Costa Rica**].

Family Mesoveliidae (Figure 4)

Mesovelia amoena Uhler, 1894

Recorded from Costa Rica without details by Spangler (1990).

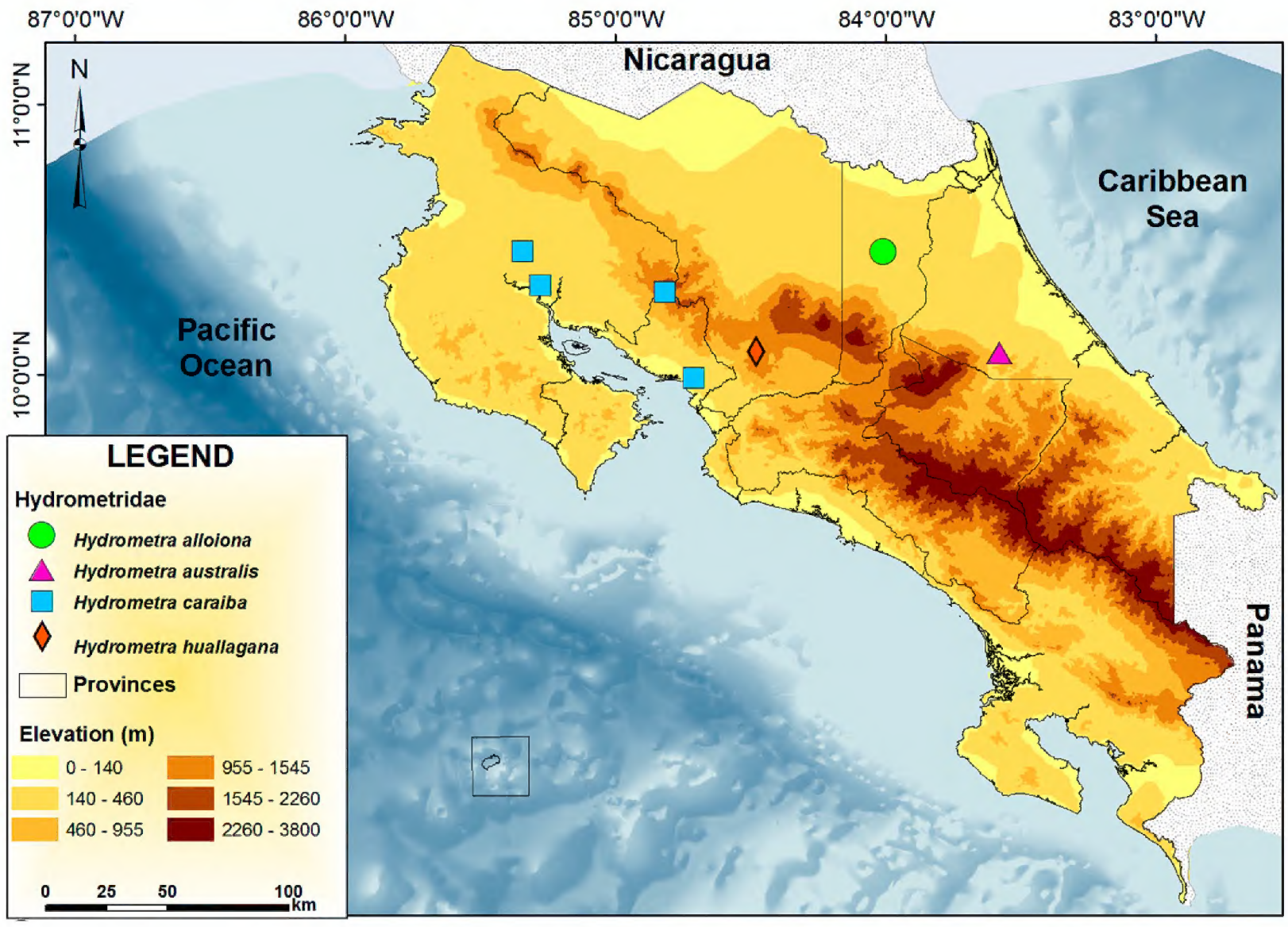

Figure 3. Map of Costa Rica showing the collecting localities of the family Hydrometridae.

Material examined. Alajuela – San Ramón, Alberto Manuel Brenes Biological Reserve, 800 m a.s.l., 10.X.2010, (B. Pacheco): 1 apterous female. Heredia – Sarapiquí, Organization for Tropical Studies, La Selva Biological Station, III-VII.1992, (A. Schlagbauer): 11 apterous females. Bosque Eterno de los Niños Private Reserve, Pocosol Biological Station, Zamia trail, spring before fumaroles, 850 m a.s.l., 27.I.2001, (M. Springer): 2 apterous females, 1 nymph. Limón – Peje Lake, Reventazón Project, 30 m a.s.l., XI.2011, (B. Pacheco & F. Reyes): 4 apterous females [**Presence in Costa Rica confirmed**].

Mesovelia mulsanti White, 1879

Known distribution in Costa Rica: San José (Neering 1954).

Material examined. Guanacaste – Bagaces, Palo Verde National Park, lake, less than 100 m a.s.l., 28.X.2005, (M. Losilla): 1 apterous female; lake, 250 m a.s.l., 11.XI.2000: 1 female with broken wings. Heredia – Sarapiquí, Cariblanco, Hule Lake, 20.X.1998, (F. Mejía): 1 apterous male, 1 nymph. Limón – Peje Lake, Reventazón Project, 30 m a.s.l., VIII.2010, (B. Pacheco): 1 apterous male, 1 nymph; XI.2011, (B. Pacheco & F. Reyes): 1 apterous male, 1 apterous female, 1 macropterous female, 1 nymph; I.2012: 1 apterous male, 3 apterous females, 8 nymphs; Peje B Lake, Reventazón Project, site 11, 12.I.2013, (B. Pacheco, J. Bermúdez & F. Villalobos): 1 apterous male, 1 nymph; Peje 2 Lake, Reventazón Project, VIII.2010 (B. Pacheco & D. Vásquez): 4 apterous males, 3 apterous females, 5 nymphs. Pococí, pond on side of road to Braulio Carrillo National Park, dense aquatic vegetation, 235 m a.s.l., 14.XI.2005, (C. Lizana): 1 macropterous female, 2 apterous females, 3 nymphs. Pococí, Guápiles, ponds on side of the road before Blanco River, 230 m a.s.l., 14.XI.2005, (G. Vargas & E. Arroyo): 5 apterous males, 2 apterous females. Puntarenas – Golfito, road to dairy farm, small pond, 12.I.2010, (M. Springer): 1 male with broken wings, 1 female with broken wings. Golfito, Golfo Dulce, Ferry Coto Colorado River, pond with hydrophytes on side of the road, 50 m a.s.l., 28.IX.1996, (M. Springer): 1 male with broken wings. Golfito, Golfo Dulce, pond on side of road after Conte River, 28.IX.1996, (M. Springer): 1 male with broken wings, 2 nymphs. Coto Brus, San Vito, lake (Cantaros?), 1000 m a.s.l., 09.XI.1992, (L. D. Gomez): 2 apterous males, 3 apterous females, 6 nymphs. Osa, Península de Osa, pond in rice field, road to Puerto Jiménez, 20 m a.s.l., 27.IX.1996, (M. Springer): 2 apterous males, 1 nymph [**First record from Guanacaste, Heredia, Limón, and Puntarenas provinces**].

Mesoveloidea williamsi Hungerford, 1929

Recorded from Río Virilla, Costa Rica, without further details by Hungerford (1938).

Material examined. Alajuela – San Carlos, San Pedro (La Tigra), unnamed stream, tributary of Peñas Blancas River, 150 m a.s.l., 20.X.2001, (M. Springer & C. Guillén): 1 macropterous male. San Ramón, San Lorenzo River, above dam, 03.VI.2013, (B. Pacheco & F. Reyes): 2 macropterous males, 2 macropterous females, 1 nymph; below dam, 300 m a.s.l., 20.V.2011 (D. Vásquez): 1 macropterous female. Upala, Site 4, pipe above Bijagua River, Canalete-Upala, VIII.2010, (F. Reyes & P. Gutiérrez): 1 macropterous male, 1 macropterous female. Cartago – Tapantí, Orosi River, 23.X.2005, (M. Werner): 1 macropterous male. Turrialba, Reventazón Hydropower Station, site 7, VI.2010, (B. Pacheco & D. Vásquez): 1 macropterous male, 2 nymphs. Guanacaste – Cañas, Site 7, confluence of South Channel and reservoir, 47 m a.s.l., VII.2010, (B. Pacheco & D. Vásquez): 1 macropterous male. Heredia – Horquetas, Puerto Viejo River, P. H. Cubujuquí, 171 m a.s.l., 18.III.2012, (B. Pacheco): 1 macropterous male. Horquetas, above ICE Project, stream behind Horquetas Gas Station, 19.VII.2012, (B. Pacheco): 1 macropterous male. La Tirimbina Reserve,

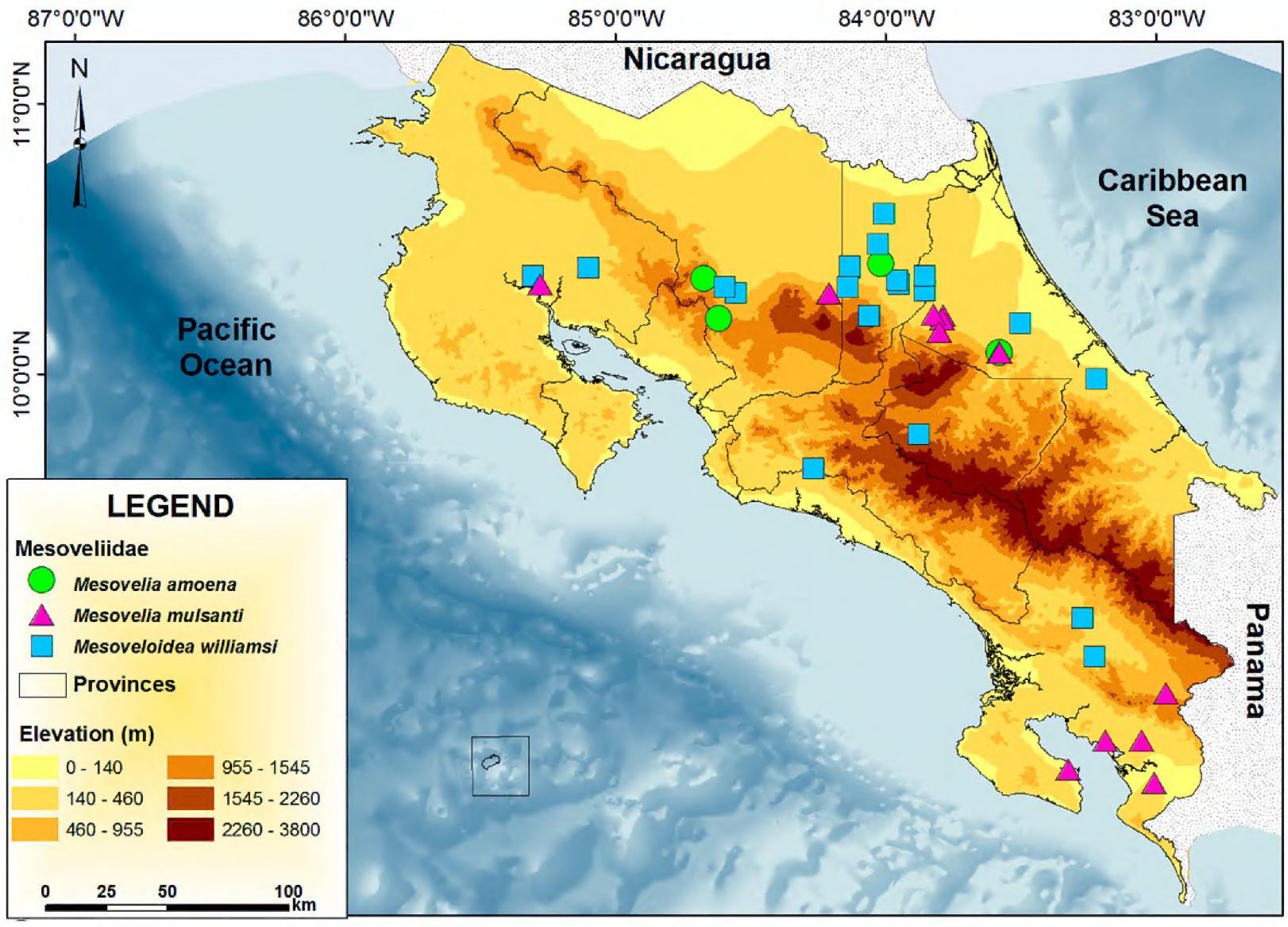

Figure 4. Map of Costa Rica showing the collecting localities of the family Mesoveliidae.

Sarpiquí River, 03.X.2005, (M. Werner): 3 macropterous males, 2 macropterous females. La Tirimbina Reserve, Sarapiquí River, 27.I.2006: 1 macropterous male, 1 nymph. Sarapiquí, unnamed tributary to Sarapiquí River, 280 m a.s.l., III.1998, (P. Paaby): 1 macropterous male, 1 macropterous female. Sarapiquí, Sarapiquí River, 200-275 m a.s.l., III.1998, (P. Paaby): 1 macropterous female. Sarapiquí, La Virgen, first order tributary to Poza Azul River, site 4, 250 m a.s.l., III.1998, (P. Paaby): 1 macropterous male, 1 macropterous female. Limón – Guápiles, Chirripó River, Site 1, below CDP, 07.VI.2011, (B. Pacheco): 1 macropterous female; Site 2, inside CDP, 07.IV.2011, (B. Pacheco): 1 macropterous female. Matina, Brazo Seco stream, site 3 above CDP, 10.I.2012, (B. Pacheco & F. Reyes): 1 macropterous male. Braulio Carrillo National Park, Botarrama Stream, 9.X.2005: 1 macropterous female; 29.I.2006: 1 macropterous male. Puntarenas – Térraba Watershed, Diquís Hydropower Project, Brujo River, 01.III.2006, (R. Lara): 1 macropterous female. Buenos Aires, Longo Mai, Corento River, Finca Sonador, 550 m a.s.l., 23.V.1998, (A. Nuñez): 1 macropterous male. Inter-American highway, Coto River, by the bridge, less than 50 m a.s.l., 25.IV.1997, (G. Umaña): 1 female with broken wings [**First record from Alajuela, Cartago, Guanacaste, Heredia, Limón, and Puntarenas provinces**].

Family Veliidae (Figure 5)

Microvelia albonotata Champion, 1898

Previously recorded from Canada to Peru, including the West Indies (Muñoz *et al.* 2010), but not specifically from Costa Rica.

Material examined. Guanacaste – Bagaces, Lomas Barbudal, river, 300 m a.s.l., 4.X.1998, (P. Ortiz): 1 macropterous male. Heredia – Sarapiquí, Organization for Tropical Studies, La Selva Biological Station, La Flaminea Marsh, III-VII.1992, (A. Schlagbauer): 6 apterous males, 1 macropterous male, 6 apterous females, 3 macropterous females. Puntarenas – Puntarenas, Barranca, ponds on road parallel to Barranca River, 45 m a.s.l., 13-16.IX.1998, (F. Mejía): 2 macropterous males, 2 macropterous females [**First record from Costa Rica**].

Microvelia argentata Nieser & Alkins-Koo, 1991

Previously recorded from Trinidad & Tobago, Brazil, and Argentina (Mazzucconi *et al.* 2009; Dias-Silva *et al.* 2013).

Material examined. Limón – Limón, unnamed stream tributary to Limoncito River, 02.V.2013, (B. Pacheco & F. Garita): 1 apterous male; Limoncito River, 18 m a.s.l.: 1 apterous male, 5 nymphs [**First record from Costa Rica**].

Microvelia laesslei Drake & Hussey, 1954

Previously known only from Jamaica (Polhemus and Polhemus 1991).

Material examined. Heredia – Rara Avis, El Plástico Station, in bromeliad tanks, I.1997, (J. Coronado): 3 macropterous females; El Atajo trail, in bromeliad tanks, 17.I.1998: 1 apterous male, 1 macropterous male, 1 apterous female, 5 macropterous females [**First record from Costa Rica**].

Microvelia mimula White, 1879

Previously recorded from Cuba to Uruguay, but not specifically from Costa Rica (Moreira 2013).

Material examined. Limón – Pococí, E.A.R.T.H., dairy wetland, 60 m a.s.l., IV.1999, (L. Luna), 2 macropterous males, 1 macropterous female [**First record from Costa Rica**].

Microvelia panamensis Champion, 1898

Previously known only from Panama and Colombia (Polhemus 1977).

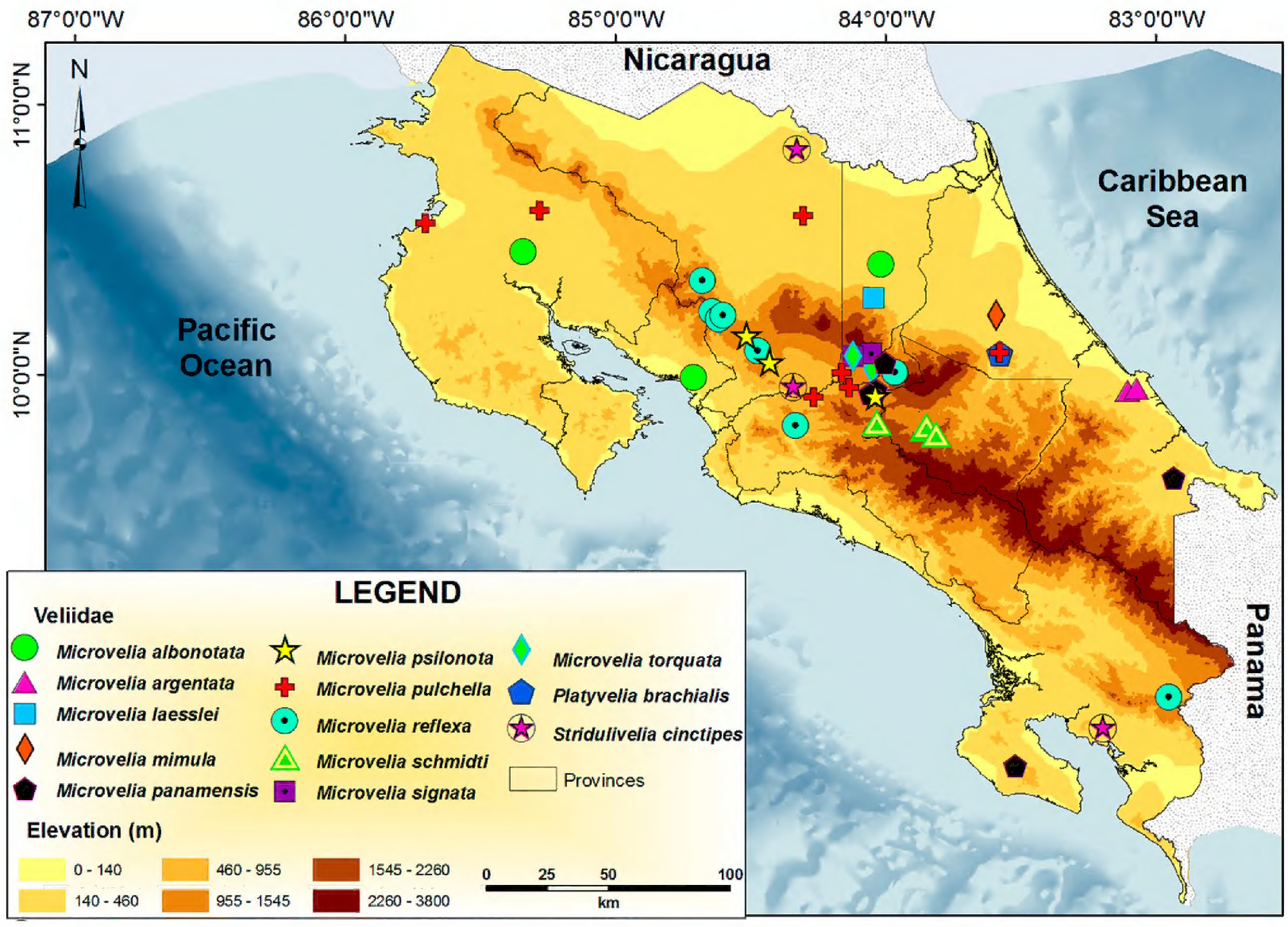

FIGURE 5. Map of Costa Rica showing the collecting localities of the family Veliidae.

Material examined. Heredia – Zurquí, near La Fonda Restaurant, ponds on way, 23.VIII.2007, (B. Pacheco): 1 apterous male, 2 apterous females, 2 nymphs. Limón – Valle de la Estr. Cerro Uatsí, pond on the way, 600 m a.s.l., 23.VIII.1998, (M. Springer): 1 apterous male, 1 nymph. San José – Montes de Oca, Los Negritos stream, 1100 m a.s.l., 01.X.2005, (R. Gómez): 2 apterous males. Montes de Oca, San Pedro, Danza del Sol Urbanization, polluted stream, 11.III.1995, (L. Vik): 1 apterous male, 1 macropterous male. Puntarenas – Osa, Península de Osa, Corcovado National Park, Claro River, near Sirena, 0 m a.s.l., IV.1999, (L. Stauffer): 1 apterous male, 2 macropterous males, 2 macropterous females [**First record from Costa Rica**].

Microvelia psilonota Polhemus, 1974

Previously known only from Mexico (Polhemus 1974).

Material examined. Alajuela – San Ramón, La Paz, sugar cane field canal, X.2000, (A. Loría): 4 apterous males, 2 macropterous males, 5 apterous females. Palmares, Zaragoza, El Puente river, 1100 m a.s.l., 12.I.2005, (F. Ruíz): 2 macropterous males, 1 macropterous female. Cartago – Tres Ríos, San Ramón, Puruses river, slow current, 1400 m a.s.l., 23.VIII.1998, (X. Miranda): 2 apterous males [**First record from Costa Rica**].

Microvelia pulchella Westwood, 1834

Previously recorded from Canada to Argentina, but not specifically from Costa Rica (Moreira 2013).

Material examined. Alajuela – Rugama Stream, Laguito, 09.V.2011, (B. Pacheco, D. Vásquez & J. Bermúdez): 1 macropterous male, 5 apterous males, 6 apterous females, 2 nymphs. Guanacaste – Bagaces, 10 Km northwest, pond, 800 m a.s.l., 8.X.1998, (P. Ortiz): 2 macropterous males, 1 macropterous female. Carrillo, Playas del Coco, near mangrove swamp, 10 m a.s.l., XII.1998, (F. Mejía): 2 macropterous males, 6 macropterous females. Heredia – Flores, San Joaquín, Forences Sciences lab oxidation lakes, 1100 m a.s.l., 18.IX.1998, (L. Fernández): 1 apterous male, 1 macropterous male, 1 apterous female. Limón – Reventazón Project, Peje I Lake, V.2011, (B. Pacheco & F. Reyes): 1 apterous male. San José – San José, Pavas, Santa Catalina, fish pond, 1000 m a.s.l., IX-X.1998, (F. Mejía): 2 apterous males, 2 apterous females, 2 nymphs. Vázquez de Coronado, Universidad de la Paz, El Rodeo, lake, 900 m a.s.l., 04.XI.2000, (E. Bermúdez): 9 apterous males, 12 apterous females [**First record from Costa Rica**].

Microvelia reflexa Polhemus (1974)

Known distribution in Costa Rica: Puntarenas (Polhemus 1974).

Material examined. Alajuela – San Ramón, Alberto Manuel Brenes Biological Reserve, 800 m a.s.l., 10.X.2010, (B. Pacheco): 11 apterous males, 2 macropterous females, 6 apterous females, 2 macropterous females. San Ramón, pond on road to Alberto Manuel Brenes Biological Reserve, approximately 1000 m a.s.l., 25.XI.1996, (M. Springer): 4 apterous males, 4 macropterous males, 4 apterous females, 2 nymphs. San Ramón, Alberto Manuel Brenes Biological Reserve, San Lorencito River, 10.X.1998: 4 apterous males, 4 apterous females, 1 macropterous female, 7 nymphs. Same site, III.1995, (R. L. Rodríguez): 1 macropterous male, 1 nymph. San Ramón, ponds on main road San Ramón Reserve, 800 m a.s.l., 14.III.1998, (G. Chaverri): 2 macropterous males, 1 macropterous female, 2 nymphs. Bosque Eterno de los Niños Private Reserve, Pocosol Biological Station, Targuasal River, tributary to Peñas Blancas River, 800 m a.s.l., 28.I.2001, (M. Springer): 2 apterous males, 3 macropterous males, 1 apterous female, 3 macropterous females. San José – Coronado, Cascajal, pond, 1500 m a.s.l., 08.X.2005, (R. Sánchez): 1 apterous male, 2 nymphs. Puriscal, Mercedes Sur, Mercedes Sur stream, 1175 m a.s.l., 22.II.1998, (C. Obando): 1 macropterous male, 1 macropterous female [**First record from Alajuela and San José provinces**]. Puntarenas – Coto Brus, San Vito, Est. Las Cruces, Jaba River, 1200 m a.s.l., II.1998: 1 macropterous female.

Microvelia schmidti McKinstry, 1937

Known distribution in Costa Rica: San José and Río Virilla, without further details (McKinstry 1937).

Material examined. Cartago – Cartago, Copalchi, pond on roadside, 2000 m a.s.l., 20.IX.1998, (L. Fernández): 2 apterous males. Orosi, pond on side of Orosi River, (C. Guillén): 2 apterous males, 4 apterous females, 6 nymphs. Orosi, marsh, 20.IX.1998, (R. Maricruz): 4 apterous males, 1 apterous female, 1 nymph. Orosi, Tapantí stream: 2 apterous males. Orosi, stagnant water, 04.IX.1998, (R. Mora): 3 apterous males [**First record from Cartago province**].

Microvelia signata Uhler, 1894

Previously known from southern United States to Central America (Henry and Froeschner 1988), but not specifically from Costa Rica.

Material examined. Heredia – La Amistad Stream, between Porrosati and Sacramento (road to Barva), 1900 m a.s.l., III-VI.1999, (T. Klug): 3 apterous males. San Rafael, Cerro Chompipe, 2000 m a.s.l., 24.IX.2000: 2 apterous males, 2 apterous females, 1 nymph [**First record from Costa Rica**].

Microvelia torquata Champion, 1898

Previously known from southern United States to Central America (Henry and Froeschner 1988), but not specifically from Costa Rica.

Material examined. Alajuela – San Ramón, Alberto Manuel Brenes Biological Reserve, 800 m a.s.l., 10.X.2010, (B. Pacheco): 6 macropterous males, 2 macropterous females. Heredia – San Isidro, 1600 m a.s.l., 2.XII.1998, (M. Bermudez): 1 apterous male, 1 apterous female. La Amistad Stream, between Porrosati and Sacramento (road to Barva), 1900 m a.s.l., V-VI.1999, (T. Klug): 2 apterous males, 3 apterous females [**First record from Costa Rica**].

Platyvelia brachialis (Stål, 1860)

Recorded from Costa Rica without details by Polhemus and Polhemus (1993).

Material examined. Limón, Peje Lake, Reventazón Project, 15.X.2010, (B. Pacheco & D. Vásquez): 1 macropterous male [**Presence in Costa Rica confirmed**].

Stridulivelia cinctipes Champion, 1898

Known distribution in Costa Rica: Puntarenas (Drake and Menke 1962).

Material examined. Alajuela –Alajuela, Cebadilla, stream on side of road, 6.XII.1998, (L. Fernández): 2 apterous females. San Carlos, Cutris, Crucitas, site 16 Sococo, 2.IX.2011, (B. Pacheco & F. Villalobos): 1 apterous male [**First record from Alajuela province**]. Puntarenas – Golfito, La Gamba Stream, I.1997: 1 apterous male; 15.I.1998: 2 apterous females.

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